HP ePrint Enterprise

Architectural Overview

Release 4.0

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1 Introduction

The emergence of mobile devices and cloud services has revolutionized business productivity and innovation. However, even the best-equipped mobile employees find themselves hunting down places to print (and get printing assistance) while on the go.

HP ePrint Enterprise is a server-based mobile printing solution that makes it easy for employees to print from mobile devices to any registered printer on enterprise network, while keeping data safely within the company network. This solution makes it simple to convert mobile content (such as Word documents, images, PDFs, etc.), into hard copy for easy reading, markup, and sharing while on the go.

The solution is easy to manage, scalable, and secure; preserves administrator control even in a BYOD environment; and allows options for mobile device management (MDM) integration.

1.1 Solution at a glance

Flexible integration

Device-to-printer connections and print job processing are managed by the server software rather than individual print drivers. As a result, HP ePrint Enterprise integrates seamlessly into existing infrastructure, supporting both HP and non-HP printers.

Enhanced data security and control

HP ePrint Enterprise helps to preserve security controls without compromising your employees' productivity. The HP ePrint Enterprise for Good, MobileIron, and BlackBerry 10 apps place corporate data in a secure container—preventing contact with the open Internet and personal apps.

IT managers can use the HP ePrint Enterprise software to control who can print, and where—such as restricting access to a dedicated printer for employees in a specific role. All job control data passes through the HP ePrint Enterprise server software, making it easy for IT to collect and analyze. For additional flexibility, the touch-to-authenticate feature enables mobile users to authenticate and release jobs using a near field communication (NFC)-enabled smartphone or tablet.

Easy mobile printing from any device

Employees can print documents from any email-capable device; from the HP ePrint Enterprise app for Android, iOS, or BlackBerry; and from the HP ePrint Mobile Driver for laptops and tablets.

2   Printing to HP ePrint Enterprise

The versatility of HP ePrint Enterprise allows IT department to choose several ways to enable cloud-based mobile printing. Depending on the organization's needs, IT department can implement app-based printing, email-based printing, or both. With HP ePrint Enterprise, truly mobile printing is now a reality.

2.1 Using email clients

Every printer added to the server via HP ePrint Enterprise admin console will have a unique email address assigned for it. With the simple email-to-print capability, users can send a print job from a corporate email address to network printers that have been assigned an email address.

To achieve the email printing, exchange server on the corporate environment should have a mechanism to route the emails intended to reach HP ePrint Enterprise Server (printer email accounts) so that it can process the job and send it to the appropriate printer for printing.

The following figure represents a high-level overview of email-to-print workflow:
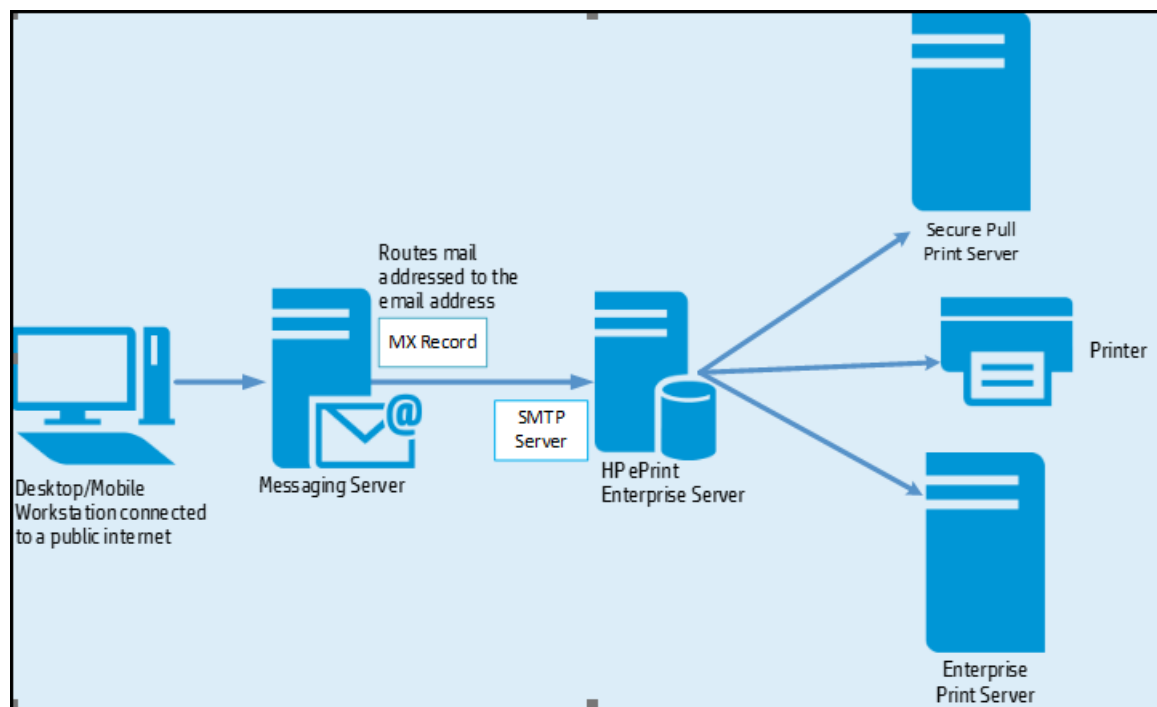
2.2 Using mobile apps

HP ePrint Enterprise Mobile apps must be downloaded and installed on mobile devices. These applications access three services provided by HP ePrint Enterprise server, for which Mobile apps must be able to establish an HTTP/S connection with HP ePrint Enterprise server.

1.   Printer searching (via HTTP/S

2.   Job submission request (via HTTP/S), and

3.   Content transfer (through email via SMTP, or content upload via HTTP/S)

Additionally, corporate email server must be able to address the HP ePrint Enterprise SMTP if content is transferred through email.

Following figure represents a high-level overview of mobile apps print workflow:

1. Select the content you want to print.
2. Select a printer.
3. Hit print.
4. Get confirmation and retrieve your documents.
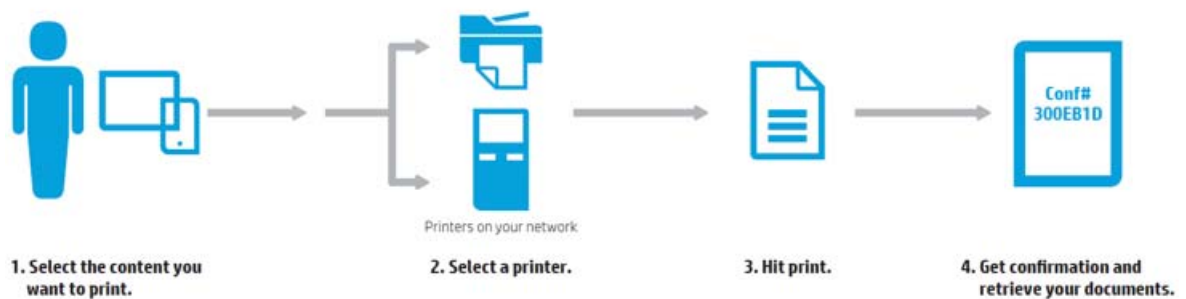
Scenario 1 — HTTP/S is the only communication protocol for all three operations. Though this seems like an easier setup, there is a drawback: printing any email content requires downloading and uploading the content back to the corporate network. If a regular mobile data connection (e.g. 3G) is being used, this means a lot of data transfer.

Scenario 2 — Typically the case for BlackBerry clients (running OS 7 and below), this scenario provides an easier method for transferring email content: simple, in-house email forward is not only cheaper (no heavy data transfer), but safer (the content never leaves the boundaries of corporate network).

2.2.1 Enterprise connectivity

For Android, iPhone, and BlackBerry (OS 10 and above) devices, the enterprise network infrastructure will have to provide clients with means to connect with HP ePrint Enterprise Server over VPN, Local Wi-Fi or an equivalent.

The following figure represents a high-level overview of enterprise connectivity over VPN:

Enabling HTTP through VPN
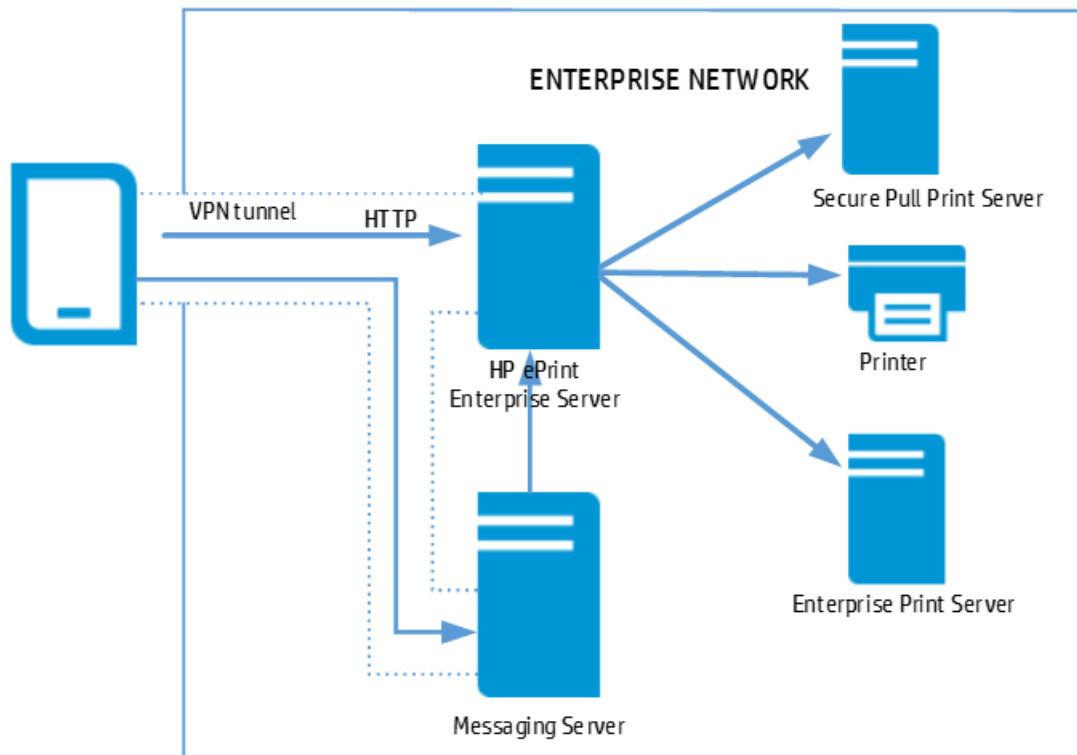
The following figure represents a high-level overview of enterprise connectivity over Local Wi-Fi:

Wi-Fi connection
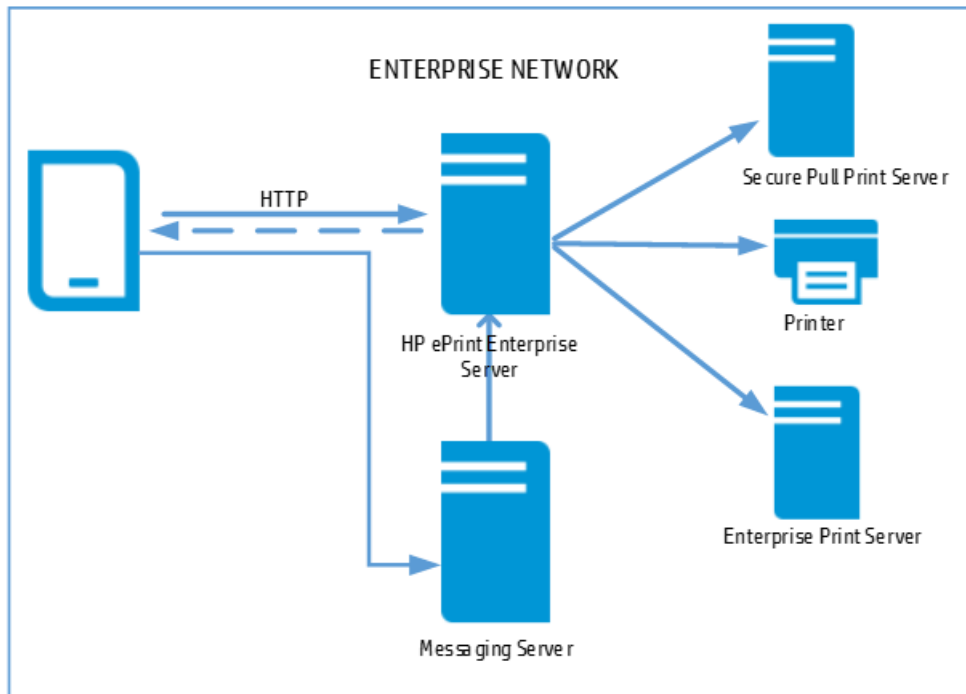
Print workflow from Android, iOS, and BB10 device

The HP ePrint Enterprise application will need to be installed on your mobile device. It can be obtained from your carrier's mobile app store. Once installed, an HP ePrint Enterprise icon should become available. This application gives users access to printable content and, subsequently, to printer searching and job submission. To enable the application to search and print to an HP Enterprise server, it needs to be registered and authorized by the server. For more information on how to set up mobile devices with HP ePrint Enterprise, refer to the *HP ePrint Enterprise Client Installation Guide*.

The following steps describe what happens with a print job from the moment it is requested in HP ePrint Enterprise, to the moment it is sent to the printer:

1. User selects content and moves to printer selection.

2. User either picks a printer from a shortcut of those last used, or searches for a new one. The printing application contains a search text box. User enters keywords that will be submitted to the HP ePrint Enterprise server in form of an HTTP/S request. The HP ePrint Enterprise server replies back with a list of results, displaying printers in the HP ePrint Enterprise database that contain any tags matching the search criteria (keywords).

3. User selects one of the printers. The next screen shows detailed information about the job and the chosen printer (including location details). The user then confirms by clicking Upload.

4. Job request (along with print job parameters such as target printer, user information, etc.) is submitted in, and content uploaded through, an HTTP/S request.

5. As files arrive, the rendering workflow begins for each job belonging to this "job group" (if multiple file jobs, typically from email and attachments) by saving the files in temporary storage. This is the only file I/O in the entire process, as rendering is streamed in memory to the printer, to guarantee maximum performance. Once the original stored file reaches a final state (printed), the file is deleted.

6. A dispatcher mechanism creates virtual queues for each file belonging to this group, allowing serialization of jobs per printer, so the Windows spooler doesn't potentially address the same printer more than once at a time. For each printer, each file will queue, then un-queue and render (from plain content to PCL/PS), and send for printing through the Windows spooler. If a job stays queued for too long, it will be re-queued according to a retry policy (configurable). If after all retries the job still can't print, the job is considered failed. Only after the job is finished printing, will the next one be un-queued and processed.

7. Once the printer is available, and the print request is un-queued, the rendering starts. The system will activate a proprietary driver installed on the HP ePrint Enterprise server which is capable of rendering in PCL 3, 5/6 and PS, and each job will be sent to the printer through port 9100 or to a Windows server queue or to a Secure Pull Print queue.

8. During this process, the driver monitors the status of the job. If bits are successfully sent to printer buffer, job will be considered printed. If something happens to prevent this (either because of printer conditions, or connection problems), the job is cancelled. Either way, the system is notified of the status, and the user receives a consolidated message after a few seconds.

9. Once the original stored file reaches a final state, the file is deleted.

2.2.2 Enterprise mobility

Enterprise mobility typically includes over-the-air distribution of applications, data, and configuration settings for all types of mobile devices, including mobile phones, smartphones, tablet computers, ruggedized mobile computers, mobile printers, mobile POS devices, etc. This applies to both company-owned and employee-owned (BYOD) devices across the enterprise, or mobile devices owned by consumers.

2.2.2.1 Blackberry Enterprise Server

Mobile Data Service (MDS) is one of the earliest ways to provide the necessary channel for HP ePrint Enterprise. BlackBerry provides this secure channel through the BlackBerry Enterprise Server (BES), so BlackBerry users have direct access to enterprise network resources as if they were directly connected to the local network – similar to a VPN connection.

Using BES/MDS to enable HTTP and e-mail in a BlackBerry environment
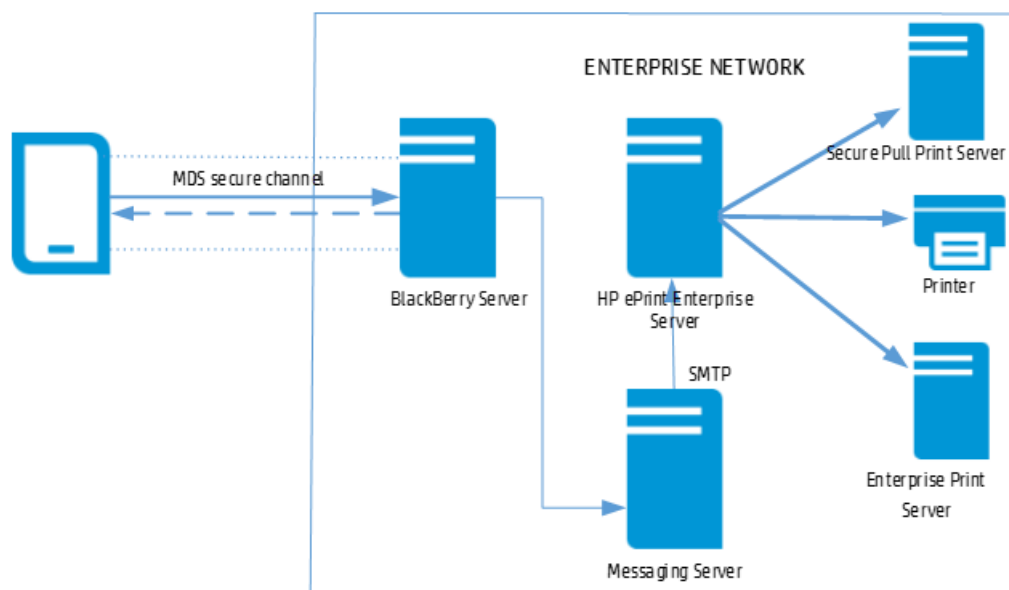
From an HP ePrint Enterprise deployment standpoint, very little needs to be done on the BES. In practical terms, BES is not part of the solution, but only an enabler to the secure communication over HTTP/S and email. For more details on BlackBerry and BES setup, refer to the HP ePrint Enterprise Client Installation Guide.

Print job from a Blackberry

Using a BES administration task, plug-in applications can be pushed to BlackBerry devices, enabling a **Print** button transparently. Users can then print through HP ePrint Enterprise.

The following steps describe what happens with a print job from the moment it is requested from the BlackBerry email application to the moment the bits are sent to the printer:

1. User selects an email and taps **Print**.

2. HP ePrint Enterprise has a search text box. User types key words that will be submitted to HP ePrint Enterprise server in form of an HTTP/S request. HP ePrint Enterprise server replies with a list of results, displaying printers in the HP ePrint Enterprise database that contain any tags matching the search criteria (keywords).

3. User selects a printer. The next screen shows detailed information about the job and the chosen printer (including location details). User then confirms by clicking **Print**.

4. Job request is submitted in two steps:

    a. Content to be printed is sent to the HP ePrint Enterprise server (via BES and email server – e.g., MS Exchange) in the form of an email forward. The HP ePrint Enterprise server contains an SMTP server waiting for email messages to be processed.

    b. BlackBerry "Print" application sends an HTTP/S request to the HP ePrint Enterprise server notifying it that the content should arrive in the printing mailbox (SMTP server), identified by a certain UID, and that this job should be sent to a specific printer. This session-based notification (step 4.b) allows HP ePrint Enterprise to create a session in the workflow, with database records that uniquely identify the job, its origin, destination, and timestamps.

5. HP ePrint Enterprise server starts print job by waiting for the email message to arrive with the content to be printed. If the email message doesn't arrive in a reasonable/configurable amount of time, the job will be considered failed. As message arrives, rendering workflow starts for each job belonging to this "job group" (i.e., email body and any combination of attachments), by saving each file in temporary storage. This is the only file I/O in the process, as rendering is streamed in memory to the printer, guaranteeing maximum performance.

6. For each file belonging to this job group, a dispatcher mechanism creates virtual queues that allow serialization of jobs per printer. This is so the Windows spooler doesn't potentially address the same printer more than once at a time. For each printer, files are queued, then un-queued and rendered (from plain content to PCL/PS), and sent for printing through the Windows spooler. If a job stays queued for too long, it is re-queued according to a re-try policy (configurable). If after all retries the job still can't print, it is considered failed. Only after the job finishes printing is the next one un-queued and processed.

7. When the printer is available, and print request is un-queued, rendering begins. The system activates a proprietary driver installed on the HP ePrint Enterprise server which is capable of rendering in PCL 3, 5/6, and PS, and each job will be sent to the printer through port 9100 or to a Windows server queue.

8. The driver monitors the status of the job during this process. If bits are successfully sent to printer buffer, the job is considered printed. If something happens to prevent this (either because of printer

conditions or connection problems), the job is cancelled. Either way, the system is notified of the status, and the user receives a consolidated message after a few seconds.

9. When the original stored file reaches a final state (printed or failed to print), the file is considered "old". Old files are deleted by an automatic cleanup mechanism, which can be scheduled by the system administrator.

2.2.2.2 Good for Enterprise

HP ePrint Enterprise for Good mobile app must be installed on the device. HP ePrint Enterprise for Good gives access to printable content and, subsequently, to printer searching and job submission. To enable search and print to an HP Enterprise server, this client needs to be registered and authorized by the Good Dynamics control server.

Good provides the necessary HTTP/S channel for HP ePrint Enterprise through the Good Dynamics Network Operation Center. With Good Technologies integrated in the HP ePrint Enterprise app, you can automatically authenticate to the HP ePrint Enterprise server without providing email address or activation code. You can also print to the enterprise printers from outside the company's network using 3G or 4G LTE (Long Term Evolution). All files are encrypted and secured during transfers from other apps or to the printer.

The following figure represents a high-level overview of HP ePrint Enterprise for Good workflow:
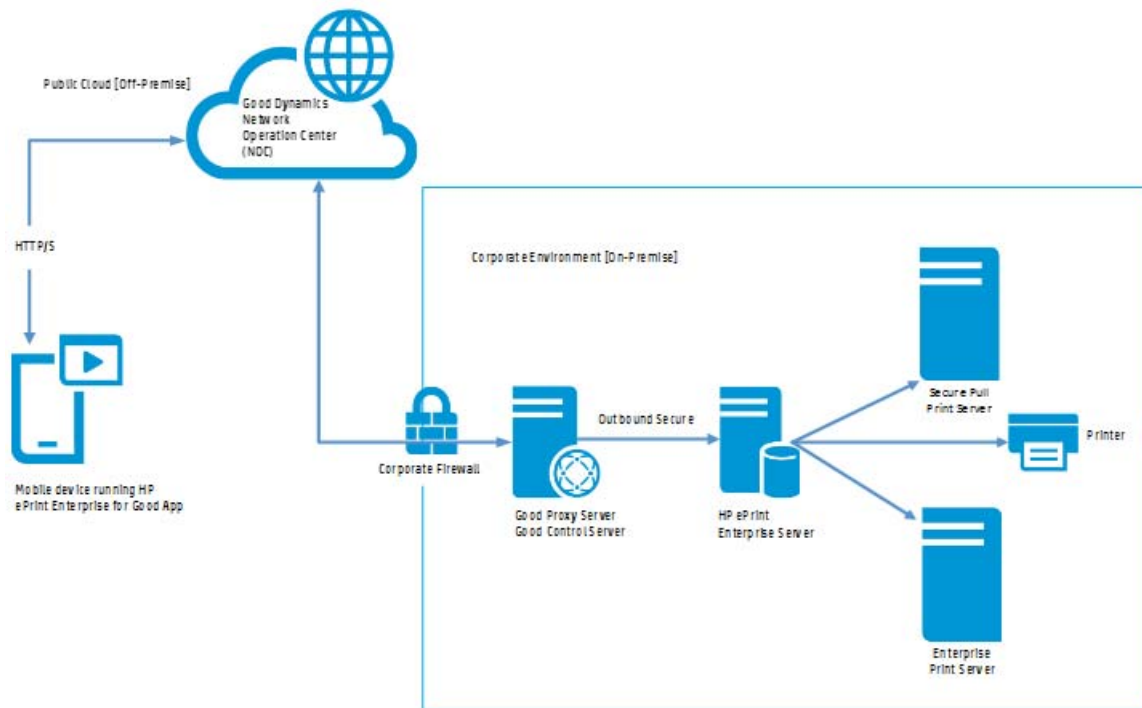
2.2.2.3 MobileIron

The HP ePrint Enterprise for MobileIron is a printing option for MobileIron customers that use iOS devices. In a MobileIron deployment, the solution includes installation of the following:

● MobileIron Core

● MobileIron Sentry

MobileIron Core provides the core functionality of the solution, while MobileIron Sentry provides either integration with ActiveSync email services or app tunneling services. You configure the initial setup of MobileIron Sentry using an on-premise and cloud. The following diagram shows on-premise Sentry.
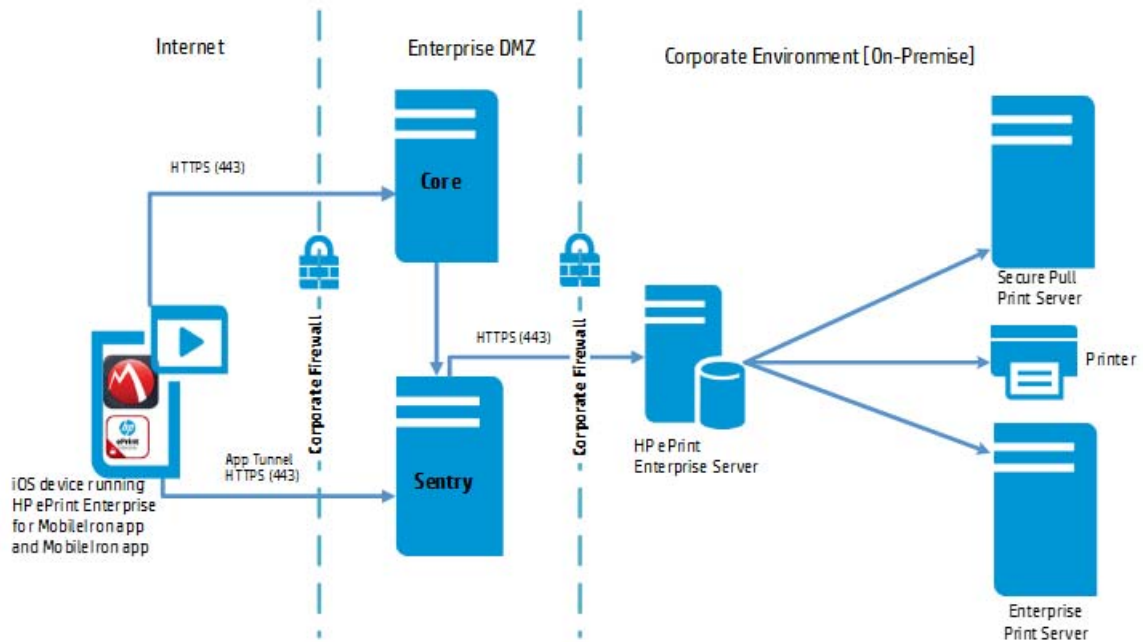
2.3 Using print system in mobile devices

2.3.1 iOS

HP ePrint Enterprise Bridge for Wi-Fi Printing gives access to instant mobile printing experience without the need to download or install additional mobile apps. HP ePrint Enterprise Bridge provides the necessary channel for printing through HP ePrint Enterprise.

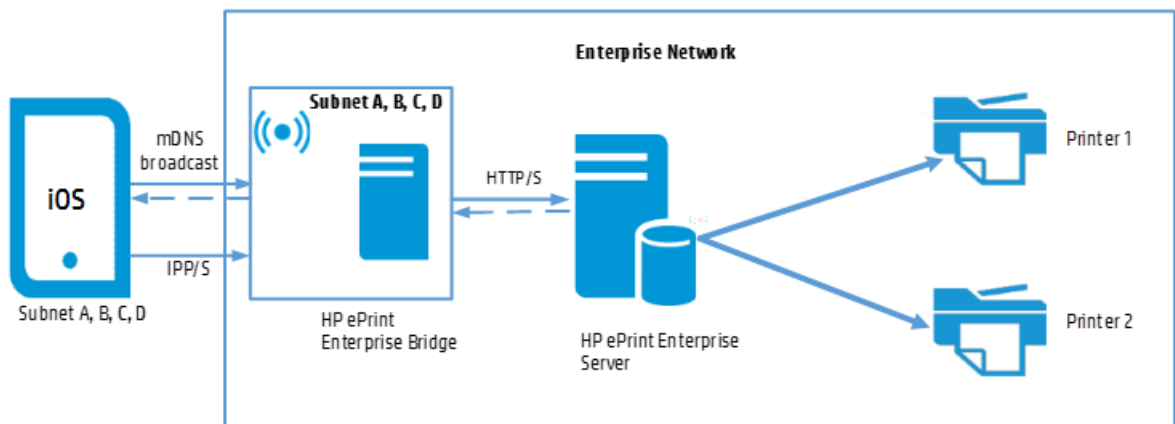The following figure represents a high-level overview of HP ePrint Enterprise Bridge for Wi-Fi Printing workflow:

3   Security

Secure mobile printing includes the following aspects:

- Cryptography: art of protecting information by transforming it into an unreadable format

- Server security: securing business logic at the back-end, which provides services to mobile devices

- Communication security: aims at providing confidentiality of information transmitted over insecure channels such as wireless links

- Content security: mitigates the risk of loss of confidential documents on the server

- Printing security: primarily deals with authorized release of print-jobs so that only authorized users can collect printed hardcopies

Each of these aspects are described in subsequent sections.

3.1 Cryptography

All encryption algorithms used in HP ePrint Enterprise are FIPS (Federal Information Processing Systems) compliant. Cryptographic keys are generated for each HP ePrint Enterprise installation and stored securely using Microsoft's industry-standard key management functions. The keys are available only to the HP ePrint Enterprise server administrator. HP does not have access to such keys.

3.2 Server security

3.2.1 User identification

HP ePrint Enterprise backend identifies users by a unique email account that must match one of the domains configured.

3.2.2 Policies

HP ePrint Enterprise backend includes a set of policies to control usage and behavior:

- **User provisioning**: users can be auto-provisioned (enrolled when accessing the backend through a mobile client), or pre-provisioned to control exactly which users are allowed to consume services from the backend. Provisioning is performed through the system console. Individual user access can be allowed or denied at any given time.

- **Printer access**: printers can be set as "out of service" at any given time through the system console.

- **Remote client configuration**: BlackBerry mobile clients in use by provisioned users can be remotely configured at any time, through the system console. Configurations include address to the backend server and base transport email account.

- **Domains serviced**: specific domain names to serve can be listed. Users with emails on different domains will not be served, even if auto-provisioning is allowed.

3.3 Communication security

This is the third aspect of secure mobile printing. HP ePrint Enterprise can accept print jobs using the HTTPS protocol or the SMTP protocol. When using the SMTP protocol, HP ePrint Enterprise server, by default, uses TLS to interact with the enterprise email server. HP encourages its customers to configure their mobile email-clients also to use TLS for interacting with their enterprise email server.

3.4 Content security

HP ePrint Enterprise backend stores data temporarily, during the lifetime of a job request:

- Emails forwarded to HP ePrint Enterprise backend are intercepted during the regular SMTP processing stack, their contents are fetched, and the email message is discarded. No email message is stored locally. Access to emails is performed using the local system account setup for HP ePrint Enterprise.

- Content is stored either in the local storage folder, or a remote storage folder indicated during setup. Specific account credentials must be provided during setup to allow remote folders. Documents that reach a final status (printed or failed) are marked as "processed." Stored processed documents are deleted periodically by system maintenance routine (frequency can be determined by IT administration setting). This is valid for both local and remote storage.

- When a document submitted is printed, HP ePrint Enterprise deletes the document on the server in a fail-safe and fool-proof manner. This practice mitigates the risk of loss of confidential documents on the server.

3.5 Printing security

3.5.1 PIN Printing

In addition, HP ePrint Enterprise natively provides a PIN-printing feature to its mobile users for optional usage. PIN printing does not rely on the enterprise identity management system unlike Secure Pull-Printing Solutions – so, it is a light-weight authorized print-job release solution. Authorized print-job release for enterprise guests is possible with PIN printing solutions. The users are provided with a job-specific PIN by HP ePrint Enterprise so that the user can request job-release from an HP Printer, which supports Job Storage.

3.5.2 Secure Pull Printing

HP ePrint Enterprise server supports the following HP Secure Pull Printing solutions in addition to non-HP Secure Pull Printing solutions.

- HP Access Control SPP
- HP Access Control SPPE

4 Service Infrastructure

This chapter describes the service level of HP ePrint Enterprise, assisting IT professionals with dimension deployments. It also describes how the system behaves in situations of peak and stress, which helps understand the limitations of the system.

4.1 Assumptions

All performance and load analysis stated in this chapter are based on a set of assumptions which attempt to describe a real use scenario. This means that any deviation from these assumptions will necessarily impact the actual results observed during normal use.

For this analysis, the following assumptions were made:

4.1.1 Average Print Job (APJ)

An APJ refers to the average computational power necessary to transfer, open, render, and print any one of the following files:

- Microsoft Word document: .docx, 14 pages, 3 images, 8,000 characters, 505 KB.

- Microsoft Excel spreadsheet: .xlsx, 3 tabs, 116 KB.

- Adobe PDF file: 8 pages, 830 KB.

- JPG image: 2512 x 2011 resolution, 612 KB.

Although each file is different in size and complexity of processing, in practical terms, this service level analysis assumes that the files are sent to HP ePrint Enterprise using an equal distribution (e.g., in a batch of 100 files, 25 of each). The job unit under analysis (from this point forward, called APJ) is, in fact, the average job generated by the combination of these four samples.

4.1.2 Hardware profile

The hardware assumed in this analysis refers to the following configuration:

- Dual Core 2.0 GHz Intel® Xeon®

- 2GB of RAM

Increases of memory and processing power do not represent equivalent improvement in performance or service level. Lower levels of the same resources (less memory or slower processors), however, have an observable degradation on service level, leading to the conclusion that the above described configuration should be considered as optimal for HP ePrint Enterprise. Increases of performance beyond these levels should be addressed by other means (i.e. scalability through primary and secondary server deployments. See the *Scalability* chapter in this document for details).
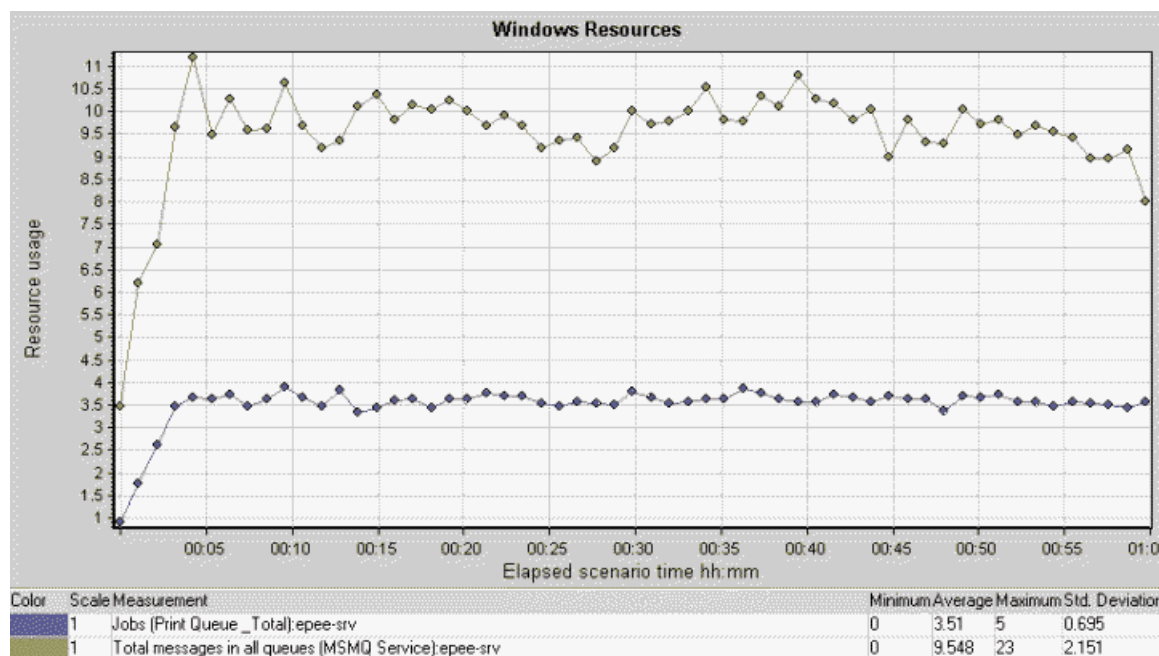
4.1.3 Network conditions

The average round trip time considered for 32-byte packets between HP ePrint Enterprise server and the printer is 250ms.

4.2 Load and processing

The following graphic compares the number of jobs being created in the print spooler (actual print jobs, blue line) per minute, and how that relates to the number of messages being queued (beige line) during a 1 hour period. For high-capacity analysis, refer to the *Peak analysis* section of this guide.

The number of queued messages indicates HP ePrint Enterprise capacity to process APJ's when they arrive for rendering. If this line indicated a growing trend (and not a stable range as in the graphic below), this would mean a progressive increase of response time (i.e. there would be more queued messages per time). This graphic indicates a stable ratio of submission and consumption during one hour, if 4 APJ's are submitted per minute.

Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	Jobs (Print Queue _Total):epee-srv	0	3.51	5	0.695
	1	Total messages in all queues (MSMQ Service):epee-srv	0	9.548	23	2.151

HP ePrint Enterprise prints 4 APJ's per minute without increase in waiting time per job. More APJ's may be submitted, but may present a different performance behavior.

4.3 Resource usage

The following graphic shows resource usage, submitting a base load of 4 APJ's per minute to a single printer, during 6 hours. As shown here, HP ePrint Enterprise resource usage fluctuates, but is capable of recovering the same levels of memory consumption - even during a 6 hour period.

It was therefore observed that HP ePrint Enterprise does show any observable memory leak over the period of 6 hours under a constant base load.

Control Memory Usage

Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	Private Bytes (Process Com.Hp.CloudPrint.Control):epee-srv	35561472	48611581.575	66068480	3760022.998
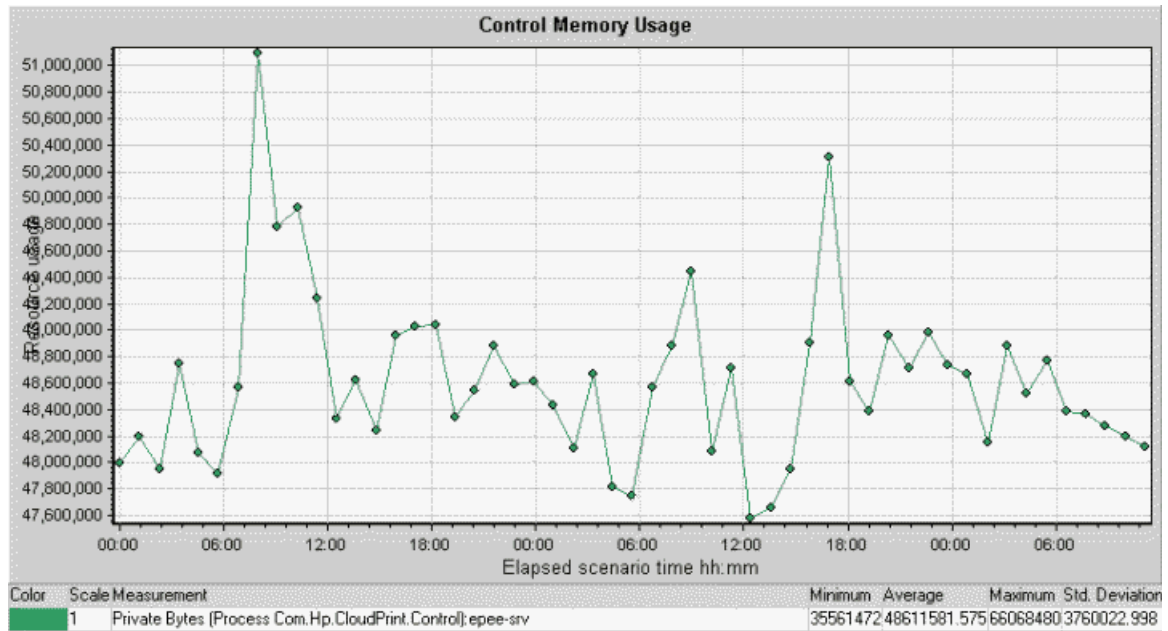
4.4 Peak analysis

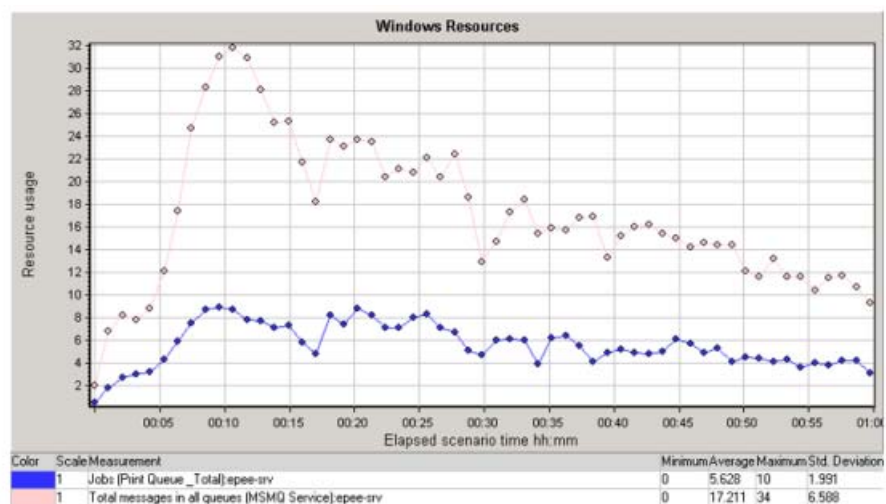Two analyses were run to verify the capacity of HP ePrint Enterprise to handle usage peaks (i.e. an increase of load during a short period of time): one with a constant base load to a single printer, and a second one starting with no load to several printers.

4.4.1 With base load

This scenario was analyzed based on the assumption that a typical system usage may have a given load considered as "base", on top of which a peak load is imposed.

The following graphic shows HP ePrint Enterprise behavior under a regular base load of 4 APJ's per minute during 5 minutes. Then a load of another 4 APJ's per minute is added to that, during a period of 3 minutes. After that, the load is back to "normal" (4 APJ's per minute). The associated table shows this progression:

Minute	# of Jobs
1	4
2	4
3	4
4	4
5	4
6	8
7	8
8	8
9	4

Windows Resources

Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	Jobs (Print Queue _Total):epee-srv	0	5.628	10	1.991
	1	Total messages in all queues (MSMQ Service):epee-srv	0	17.211	34	6.588

The blue curve represents the number of jobs being created in the print spooler as traffic is generated, as per the above table. Notice the increase in this number after 5 minutes, and how the message queuing

mechanism behaves to that (pink line), slowing down the reaction time as the load increases. After the 8th minute, the peak is ended, and the load is back to approximately 4 APJs/min.
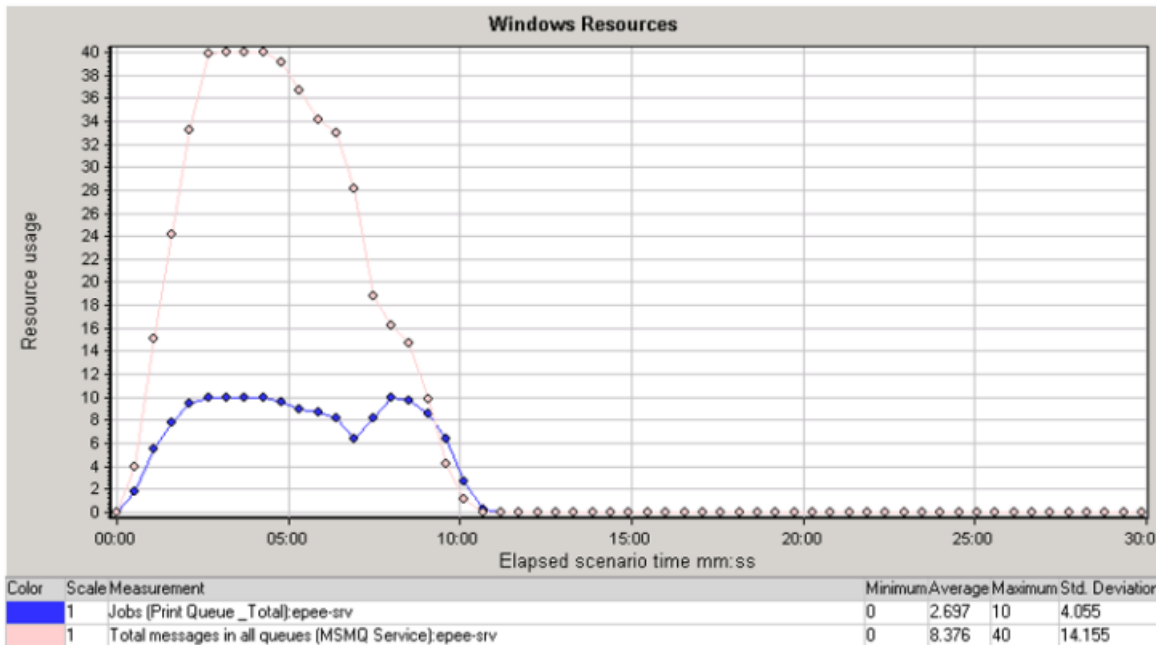
The pink curve represents the number of messages being queued (which indicates control messages needed to process the job), and how quickly HP ePrint Enterprise can consume them and get jobs printed. Notice that this number still grows a couple minute after the submission peak ends, as there is some latency between submission of the job and the queuing of messages for processing. After the 10th minute, HP ePrint Enterprise is capable of starting to consume messages more quickly than they are created, considering the base load of 4 APJs/min.

With the default timeout for queued messages set at 10 minutes, all jobs will eventually be handled with success. However, it takes HP ePrint Enterprise about 1 hour to recover from that, and reach about the same number of queued messages observed before the peak.

4.4.2 Without base load

This scenario was analyzed based on the assumption that a typical system usage may have absolutely no base load (i.e. no initial activity or queued job requests), on top of which 40 APJ's can be sent to 10 different printers, all at once. The processing of each printer is serialized, so 10 printers mean 10 parallel processes – which explain the 10 simultaneous APJ's top of the blue line. If more printers were involved, the blue line would top at this number.

In this scenario, HP ePrint Enterprise was able to instantly accept 40 APJ's, taking approximately 10 minutes to finish processing them.

| Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	Jobs (Print Queue _Total):epee-srv	0	2.697	10	4.055
	1	Total messages in all queues (MSMQ Service):epee-srv	0	8.376	40	14.155

Instant load: system is idle, 40 APJ's are sent to 10 different printers.

5 Scalability

HP ePrint Enterprise can be deployed in a primary/secondary server layout to balance the load for larger printer fleets. In this layout, a single primary server will be responsible for the database operations (searching, user authentication, activity logging, etc.) and routing print job requests to other secondary servers. Secondary servers will then be responsible for rendering and printing only. Primary servers can also be set to perform rendering and printing for a given set of printers, but can also automatically take over that responsibility in case of a secondary server failure.

The balancing mechanism is static and related to printer distribution: each server (be it primary or secondary) will be responsible for addressing a defined set of printers. If a print job is sent to printer A that is hosted by a secondary server S1, the job is forwarded to S1 for rendering and printing. If S1 becomes unavailable for any reason, the primary server M will take over and execute job on printer A. If a job is sent to a printer B that is hosted by M (the primary server), jobs sent to this printer will only be processed by M. As of this version, there is no failover mechanism for a primary server.

The following diagram illustrates a primary/secondary server deployment layout:
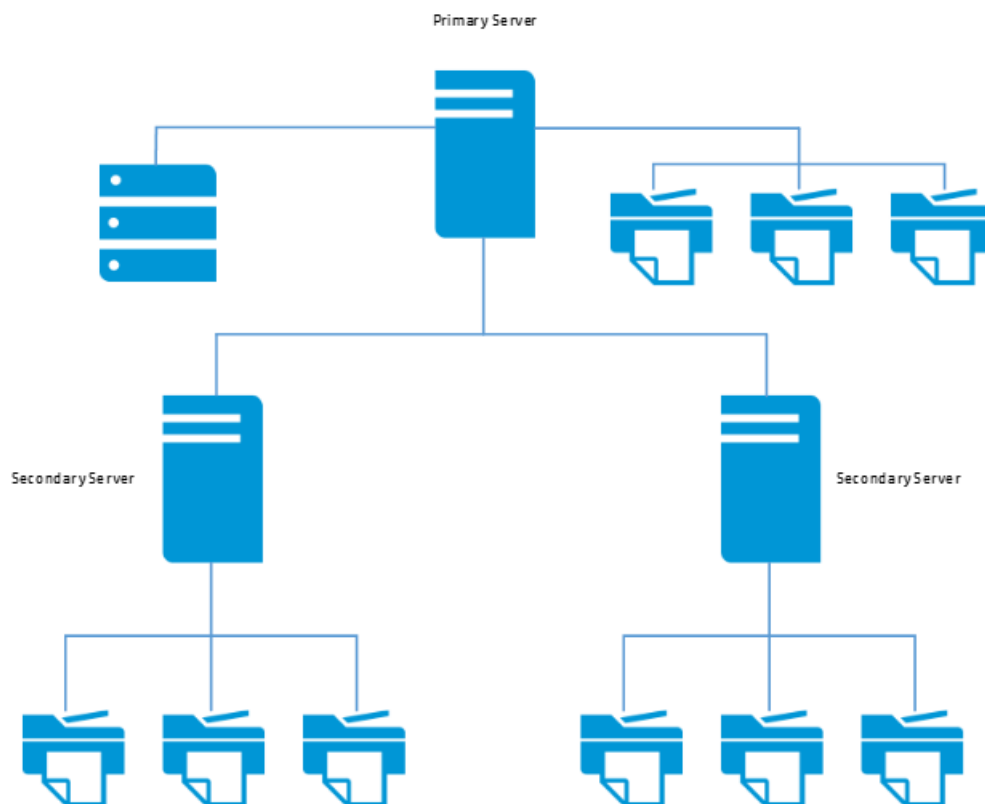
Secondary servers have no information about the primary server. The primary server controls the database records identifying all registered secondary servers. A secondary server that is not registered as a valid host in the database will not be accessible.

5.1 Sizing of a primary/secondary layout

Each installation of HP ePrint Enterprise must have at least one primary server to control all database operation. Serviceability, however, depends on capacity to render and send print jobs to printers. To maintain or improve serviceability in high-load scenarios, rendering and printing can be balanced through secondary servers, according to printer fleet distribution, taking both network and load/traffic aspects into account.

Briefly stated, primary/secondary server distribution can be designed based on the following premises:

- **One server per subnet/geographical location**: high-latency or narrow network bandwidth between the HP ePrint Enterprise server and a printer will affect performance.

- **300 printers per server**: even though the overall performance depends on cultural factors (such as actual average print job type, size and frequency), this number can be used as a general rule of thumb. Improved performance can be attained by increasing the number of servers; if load is not an issue, saving on hardware resources can be addressed by increasing the number of printers per server. Theoretically, one primary server can handle several thousand printers without a problem. It is the associated odds of having more simultaneous print jobs sent to the same server that should be taken into account, based on service level details described in the chapter 3.

For a more elaborate analysis, the following aspects should be considered:

- **Network bandwidth between geographical locations** – If your operation is distributed among sites that are connected through a slow link, it is recommended that you have one secondary server per location, closer to the printers. It is suggested that plain content be transferred across different sites, rather than having rendered/printing traffic go through that channel.

- **Distribution is done on a printer basis** (i.e., printers are assigned to host servers). It is a good idea to balance this assignment based on traffic to those printers. For example, if 20% of the printers are responsible for 80% of the traffic, you should consider distributing the printers instead of concentrating them on the same primary or secondary server. If there are a total of 1000 printers (200 of them used 80% of the time), you could have approximately 5 HP ePrint Enterprise servers, each one getting 40 of those 200 more popular devices.

- **The number of BES servers** typically does not qualify as a good criterion for distributing HP ePrint Enterprise servers. There is no technical requirement binding BES and HP ePrint Enterprise servers (BES is just a secure channel enabler). However, the total number of users associated to those BES' may indicate a distribution factor.